



Oregon

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December 10, 2008

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Tom McCue, Environmental Manager
Siltronic Corporation
7200 NW Front Avenue
Portland, OR 97210

**Re: Revised Enhanced In-Situ Bioremediation Work Plan
Siltronic Corporation
Portland, Oregon
ECSI No. 183**

Dear Mr. McCue:

The Department of Environmental Quality (DEQ) reviewed the "Revised Enhanced In-Situ Bioremediation Work Plan," dated October 20, 2008 (Revised EIB Work Plan). Maul Foster & Alongi, Inc. prepared the Revised EIB Work Plan on behalf of the Siltronic Corporation (Siltronic). The Revised EIB Work Plan provides Siltronic's revised approach to using enhanced in-situ bioremediation in the vicinity of the former solvent underground storage tank system (Former UST System).

Siltronic previously submitted the EIB Work Plan¹ and Phase I Injection Plan². The EIB Work Plan presented Siltronic's initial proposed approach to using EIB in the Former UST System vicinity, including recommendations for conducting drilling and sampling work to further delineate the nature and extent of contamination; a preliminary injection zone design (i.e., saturation approach in the immediate vicinity of the Former UST System); the numbers and locations of monitoring wells to assess EIB performance; and a performance monitoring program. The Phase I Injection Plan supplemented the EIB Work Plan by providing the results of the additional delineation drilling and sampling work and a modified approach to applying EIB (i.e., a "permeable reactive barrier" [PRB] approach). DEQ considered the EIB Work Plan and Phase I Injection Plan to be companion documents.

In a letter dated September 30, 2008 (September 30th Letter), DEQ provided Siltronic comments on both submittals, and indicated the two documents should be combined, revised, and resubmitted. Siltronic and DEQ discussed the September 30th Letter during a meeting on October 1, 2008. The Revised EIB Work Plan has been prepared in response to the September 30th Letter and October 1st meeting discussions. Given the status of the Siltronic property in the Portland Harbor, DEQ provided copies of the Revised EIB Work Plan to the U.S. Environmental Protection Agency (EPA). A copy of the EPA's comments letter dated November 20th is attached. DEQ considers

¹ Maul Foster & Alongi, Inc., 2008, "Enhanced Bioremediation Source Control Work Plan," May 12, a work plan prepared for Siltronic Corporation.

² Maul Foster & Alongi, Inc., 2008, "Addendum to the Enhanced Bioremediation Source Control Work Plan – Phase I Injection Plan," August 19, a work plan addendum prepared on behalf of Siltronic Corporation.

EPA's comments to have been captured by the condition for Siltronic to delineate and prepare an injection plan for the new source area found south of the Former UST System, and our comments regarding the numbers, locations, and depths of performance monitoring wells (PMWs).

Subsequent to receiving EPA's letter, Siltronic and DEQ met on November 26th to review and discuss agency comments. This letter reflects DEQ's understandings of those discussions and the agreements reached during the meeting. The primary purpose of the letter is to inform Siltronic that DEQ is approving implementation of the Revised EIB Work Plan subject to the following conditions.

- Although the source area presented in Figure 3-2 likely encompasses the majority of the highest concentrations of trichloroethene (TCE), there remains uncertainty regarding the location of the 11,000 micrograms per liter (ug/L, or parts per billion) contour southwest, west, north, and northeast of the Former UST System³. Southwest of the Former UST System, Siltronic will be conducting additional delineation work and developing an EIB injection approach. Further delineating TCE concentrations northeast of the Former UST System is not possible due to necessary facility equipment and the Fab 1 building. North of the Former UST System, Siltronic will be collecting additional VOC data west of push-probe boring GP-122 to determine the western limits of the PRB portion of the EIB application area(s). Additional delineation work is not proposed west of the Former UST System (i.e., push-probe GP-121 vicinity). DEQ is concerned that groundwater impacted by TCE at levels above 11,000 ug/L could migrate outside and beyond the EIB application area(s) west of the Former UST System. To address this potential issue Siltronic should:
 - Further delineate the extent of trichloroethene (TCE) concentrations exceeding 11,000 ug/L west of push-probe boring GP-121; and
 - Expand the western portion of the “northern supplemental injections” to encompass TCE concentrations exceeding 11,000 ug/L in the vicinity of push-probe boring GP-121.
- As mentioned above, Siltronic will be conducting additional delineation work upgradient (south) of the Former UST System in a potentially new source area of VOC contamination. This work will form the basis for an additional phase of injections (i.e., MGP DNAPL injections). The results of the delineation work along with the proposed EIB injection scheme should be provided to DEQ for review prior to being implemented.

In addition to the conditions listed above, DEQ expects Siltronic to address the comments provided below. DEQ's comments are being provided to clarify our understanding, expectation, and/or position on the referenced item(s).

GENERAL COMMENT

Siltronic provides recommendations for EIB performance monitoring (i.e., demonstration points), projected timeframes for meeting RAOs, and guidelines for implementing contingencies in Section 4 of the Revised EIB Work Plan. DEQ has a number of clarifying comments regarding this section of the document.

³ Compass directions reference true north.

- Siltronic indicates in Section 4.1, “The primary RAO for the source area is to reduce concentrations of TCE in groundwater to below the injection threshold, or 11,000 ug/L.” DEQ agrees reducing TCE to less than 11,000 ug/L is an RAO for the Former UST System vicinity, but meeting Joint Source Control Strategy⁴ (JSCS) criteria for TCE and its breakdown products at the riverbank is overall a superior benchmark for confirming EIB effectiveness (also confirms downgradient expansion of the VOC plume is not occurring). In addition, DEQ concurs with Siltronic regarding using new PMWs to document JSCS criteria have been met (i.e., groundwater concentrations are less than JSCS criteria immediately downgradient of the Fab 1 building).
- The September 30th Letter informed Siltronic that simply scaling up EIB to duplicate the performance of the pilot study will not achieve RAOs. However in Section 4.2, Siltronic bases the conceptual timeframes for achieving RAOs on the results from source zone pilot study area (SZPSA) by indicating:
 - TCE concentrations will be reduced to below 11,000 ug/L in less than: 1) 6 months in the EIB injection areas; and 2) 11 months 20 feet downgradient of where EIB is injected; and
 - Concentrations of cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) should be on declining trends 20 feet downgradient of EIB injection areas less than 26 months following injection.

Each of the timeframes referenced above are based on SZPSA results. Siltronic further indicates timeframes for meeting the RAOs cannot be predicted because of the combined effects of natural and enhanced VOC degradation. Siltronic proposes using the PMW monitoring network to, “...confirm the extent and effectiveness of the combination of natural attenuation and EIB from the source area at the riverbank.” However, Siltronic does not provide details of how PMW data will be used for these purposes. Without performance monitoring objectives it is not clear how EIB effectiveness (i.e., VOC concentrations less than JSCS criteria downgradient of Fab 1; preventing expansion of the VOC plume downgradient) will be evaluated.

- Section 4.3 provides Siltronic’s contingencies for reinjection. A list of data trends is provided for use in assessing the need for reinjection (e.g., oxidation-reduction potential, incomplete sequential dechlorination, dehalobacteria population decline), but there is no discussion of how the data alone or in combination will inform decisions to trigger contingencies.

The information provided in Section 4.2 and Section 4.3 does not address DEQ’s September 30th comments. Based on the November 26th meeting discussions, DEQ understands Siltronic will prepare and submit a performance monitoring plan providing EIB performance monitoring objectives and effectiveness criteria (e.g., achieving downgradient target concentrations, indicative VOC and/or inorganic chemistry trends), and numerical triggers for selecting and implementing injection/reinjection contingencies. Given its location between PMWs upgradient and downgradient of Fab 1, DEQ is particularly interested in developing EIB performance objectives/effectiveness criteria for the angled monitoring well to be installed under the building.

⁴ EPA and DEQ, 2005, “Portland Harbor Joint Source Control Strategy – Final,” December (note Table 3-1 revised July 16, 2007), a guidance document prepared jointly by the US Environmental Protection Agency and Oregon Department of Environmental Quality.

Siltronic indicated groundwater data from PMWs is needed to develop a monitoring plan that meets the needs of the project. Given this information, DEQ expects that within 30 days of receiving the preliminary analytical results for the PMWs located downgradient of Fab 1, Siltronic will submit the plan.

SPECIFIC COMMENTS

Section 1.1. With regard to Siltronic's obligations under DEQ Order No. VC-NWR-03-16 (the VOC Order), DEQ would refer Siltronic to the September 30th Letter and our comment to Section 1.1 of the EIB Work Plan. For additional clarification, Siltronic's obligations under the VOC Order are not deemed satisfied until DEQ has issued a certification of completion (see Section 7). Furthermore, Siltronic remains subject to DEQ Order No. ECVN-NWR-00-27 (the Joint Order), which requires NW Natural and Siltronic to implement source control measures for unpermitted discharges and/or migration of contaminants to the Willamette River or its sediments, including co-mingled VOCs and MGP contaminants.

Section 2.1. For clarification, Siltronic's evaluation of the influence of the shoreline hydraulic control/containment system on hydraulic gradients operating in the vicinity of the Former UST System should include two scenarios: 1) expansion of the VOC plume in the downgradient direction (i.e., towards the extraction wells); and 2) reduced groundwater residence time in the treatment area(s).

Section 2.2, 2nd paragraph. Section 3.1.5 of the Revised EIB Work Plan indicates additional delineation work detected VOCs in groundwater at shallower depths than expected upgradient of the Former UST System. According to Siltronic the detections, "...may represent a separate, discrete release of TCE that was not indicated by earlier data or a wider area of impact resulting from previously identified releases." Section 3.1.9 of the work plan outlines an approach for further assessing the nature and extent of this contamination. The proposed work will include further profiling of soil, potential MGP dense non-aqueous phase liquids, and groundwater for the presence of VOCs.

In areas where there is the potential for new sources of contamination to be present, such as discussed above, DEQ considers soil sampling and analysis to be warranted. DEQ will expect Siltronic to collect soil samples at minimum depth intervals of 5 feet below ground surface (bgs), and at or near the water table at each boring location. Soil samples should be analyzed for VOCs.

Section 2.5. Siltronic indicates, "...DEQ modified the RAO to include establishing declining trends for TCE daughter products (DCE isomers and VC) in WS-18-71/101." This is not the case. The RAO is not limited to the WS-18 monitoring well pair. DEQ's expectation is that groundwater leaving the treatment area will have declining cis-1,2-DCE and VC concentration trends, as measured at all of the PMWs located between the Fab 1 building and the PRB. DEQ understands from the November 26th meeting discussions that Siltronic expects the revised approach to using EIB will achieve this objective in less than 26 months.

Section 3.2.1. It is not clear to DEQ the depth of EHC/KB-1 applications is below the depth of TCE concentrations exceeding 11,000 ug/L throughout the area identified for treatment. To ensure this is the case, the lower-most injections at the locations comprising the “western PRB” and the “northern supplemental” injection area, should occur at 110 feet bgs.

Section 3.2.4.2. DEQ’s concern regarding the build-up and persistence of cis-1,2-DCE and VC downgradient of the source zone pilot study area (as measured at the WS-18 monitoring well pair) was first communicated to Siltronic in our February 14, 2008 comments letter regarding the VOC Plume FFS⁵.

Section 3.3. DEQ understands sealant materials and the procedures for sealing boreholes and monitoring wells described in this section of the work plan have been replaced by those included in DEQ’s October 23, 2008 e-mail regarding this matter.

Section 3.4.2. An additional performance monitoring well should be added downgradient of WS-30-106 to monitor groundwater leaving the western end of the PRB and before it passes under the Fab 1 Building. Siltronic should be advised that additional monitoring wells located at or near the riverbank may be warranted based on the results of monitoring groundwater in the PMWs located immediately downgradient of the Fab 1 building.

DEQ understands Siltronic will be drilling and installing an angled monitoring well under the Fab 1 building, and is currently evaluating locations and methods to perform this work. DEQ anticipates an addendum to the Revised EIB Work Plan will be prepared detailing the rationale for the location and design of the angled monitoring well, and providing drilling and installation procedures. DEQ considers groundwater monitoring under Fab 1 to be an essential component of the EIB performance monitoring program. A meeting should be scheduled to discuss planning and design of the angled installation as early in December as project team schedules allow.

In general, PMWs, including the angled boring, should be installed well in advance of EIB injections to allow groundwater samples representative of pre-treatment conditions to be collected.

Section 3.6. Siltronic recommends installing PMWs downgradient of the treatment areas after EHC injections have been completed to minimize the potential for injectate to infiltrate the screens of the installations. DEQ considers it important to have groundwater samples representative of pre-treatment groundwater chemistry (i.e., baseline water quality and VOC concentration data) for assessing the influence of EIB downgradient of the treatment area(s). During the November 26th meeting, Siltronic and DEQ agreed that EHC injections and PMW installation between treatment areas and Fab 1 will proceed concurrently to expedite use of EIB. EHC injection will be initiated at the locations furthest from Fab 1 (i.e., the upgradient-most [southern] locations), and progress downgradient towards Fab 1. This approach will allow EIB to be implemented while PMWs are being constructed and sampled, but before the effects of EIB reach the installations.

⁵ Maul Foster & Alongi, Inc., 2007, “Focused Feasibility Study - Siltronic Corporation, Portland, Oregon” October 23 (as amended December 19th), a report prepared for Siltronic Corporation.

Section 4.1. The EIB injection approach was modified with the objective of having cis-1,2-DCE and VC concentrations downgradient of the EIB treatment areas on declining trends in less time than observed at PMW cluster WS-18-71/101. For this purpose, data from PMWs located between Fab 1 and the PRB should be used.

Section 4.2. See DEQ's comment to Section 2.5.

Figure 1-1. The "locality of the facility" (LOF) should be drawn to encompass the maximum extent of VOCs exceeding relevant screening criteria. The LOF should not be limited to TCE, but should take into consideration other VOCs (e.g., cis-1,2-DCE or VC). For example, Figure 4-15A from the RI Report⁶ indicates VC concentrations exceeding screening criteria are greater in extent than the LOF shown in Figure 1-1 of the Revised EIB Work Plan. Figure 1-1 should be reviewed and revised accordingly. This comment has been carried over from the September 30th Letter.

Figure 1-7. Trend lines for deep and shallow VC data appear to be transposed. The figure should be reviewed and revised as appropriate.

NEXT STEPS

DEQ previously provided Siltronic with verbal approval to conduct additional delineation work north of push-probe boring GP-122 and upgradient of the Former UST System. As soon as practicable, Siltronic should initiate the supplemental delineation work described in this letter (i.e., delineating TCE concentrations greater than 11,000 ug/L west of GP-121; characterization of the new source area upgradient of the Former UST Building). The results of this work, and the results of the delineation work completed near GP-122, should be provided as a supplement to the Revised EIB Work Plan. The additional delineation work forms the basis for expanding the PRB north and the area of the "northern supplemental injections," and laying out the "MGP DNAPL injection" area. Prior to initiating EHC injections in these areas, DEQ will expect Siltronic to provide injection plans for review and approval.

Siltronic and DEQ have previously discussed drilling and installing the PMWs proposed in the Revised EIB Work Plan. On October 16, 2008 by telephone and via e-mail, DEQ approved Siltronic moving forward with the PMWs located downgradient of Fab 1, and provided recommendations for the well screen depths for these installations. During telephone calls on November 24th and December 9th, DEQ approved Siltronic proceeding with the PMWs between Fab 1 and the EIB treatment areas, and provided recommended screen depths for the installations. Drilling and installation of PMWs is ongoing. Additionally, during the meeting on November 26th, DEQ approved Siltronic injecting EHC in the upgradient-most treatment area (i.e., southern-most) shown in Figure 3-6 of the Revised EIB Work Plan, with injections progressing downgradient

⁶ Maul Foster & Alongi, Inc., 2007, "Remedial Investigation Report", April 16, a report prepared for Siltronic Corporation.

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towards Fab 1. DEQ understands EHC injection work was initiated during the week beginning December 1st.

DEQ and Siltronic should meet as soon as schedules allow in December, to further discuss development of EIB performance objectives and effectiveness criteria, and the design and drilling, and installation procedures for the angled PMW under Fab 1. DEQ also expects Siltronic to provide written confirmation that the conditions and comments communicated in this letter will be incorporated into Revised EIB Work Plan and implemented in the field.

Please call me at (503) 229-5543 if you have questions regarding this letter.

Sincerely,

Dana Bayuk, Project Manager
NWR Cleanup Section

Attachment: EPA November 20, 2008 Comments Letter

Cc: Alan Gladstone, Davis Rothwell Earle & Xochihua, P.C.
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Eric Bakkom, MFA
Bob Wyatt, NW Natural
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Matt McClincy, DEQ/PHS
ECSI No. 183 File
ECSI No. 84 File